

CLAIMS

I claim:

1. A seal for sealing a shaft, the seal comprising:
a sleeve constructed to be disposed generally coaxially around the shaft and comprising a first flange extending generally radially outward from the sleeve;
an outer housing configured to generally surround the sleeve and the first flange and comprising a case body, a second flange extending generally radially inward from the case body and a faceplate extending generally radially inward from the housing;
a first elastomeric lip extending generally between a portion of the first flange and a portion of the faceplate and including a base and a tip, wherein the tip is oriented generally radially inward; and
a second elastomeric lip including a base secured to the second flange and a tip displaceable against the sleeve, wherein the tip is oriented generally radially outward.
2. The seal of claim 1, wherein the tip of the second elastomeric lip is displaceable against the first flange.
3. The seal of claim 1, further comprising a third elastomeric lip including a base secured to the second flange and a tip displaceable against the sleeve.
4. The seal of claim 3, wherein the tip of the third elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the axis of the shaft.

5. The seal of claim 3, wherein the tip of the third elastomeric lip is oriented generally axially outward.

6. The seal of claim 3, wherein the tip of the third elastomeric lip is oriented generally axially inward.

7. The seal of claim 3, wherein the tip of the second elastomeric lip is displaceable against the first flange.

8. The seal of claim 3, further comprising a fourth elastomeric lip including a base secured to the second flange and a tip displaceable against the sleeve.

9. The seal of claim 8, wherein the tip of the fourth elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the axis of the shaft.

10. The seal of claim 8, wherein the tip of the fourth elastomeric lip is oriented generally axially outward.

11. The seal of claim 8, wherein the tip of the fourth elastomeric lip is oriented generally axially inward.

12. The seal of claim 8, wherein the tip of the second elastomeric lip is displaceable against the first flange.

13. The seal of claim 8, further comprising a fifth elastomeric lip including a base secured to the second flange and a tip displaceable against the sleeve.

14. The seal of claim 13, wherein the fifth elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the axis of the shaft.

15. The seal of claim 13, wherein the tip of the fifth elastomeric lip is oriented generally axially inward.

16. The seal of claim 13, further comprising a garter spring associated with the fifth elastomeric lip.

17. The seal of claim 1, further comprising a third elastomeric lip including a base secured to the first flange and a tip displaceable against the housing, wherein the tip is oriented generally radially and axially outward.

18. The seal of claim 17, wherein the tip of the third elastomeric lip is displaceable against a part of the housing that is generally parallel to the axis of the shaft.

19. The seal of claim 17, wherein the tip of the third elastomeric lip is displaceable against the case body.

20. The seal of claim 1, wherein the tip of the first elastomeric lip has a generally acute point.

21. The seal of claim 20, wherein the first elastomeric lip has an acute undercut angle.

22. The seal of claim 1, wherein the base of the first elastomeric lip is secured to the first flange, the tip of the first elastomeric lip is displaceable against the faceplate, and the tip of the first elastomeric lip is oriented both generally axially outward and radially inward.

23. The seal of claim 1, wherein the first elastomeric lip is configured and oriented to guide inward traveling debris from the tip of the first elastomeric lip towards the base of the first elastomeric lip.

24. A seal for sealing a shaft, the seal comprising:
a sleeve constructed to be disposed generally coaxially around the shaft and comprising a first flange extending generally radially outward from the sleeve;

an outer housing configured to generally surround the sleeve and the first flange and comprising a case body, a second flange extending generally radially inward from the case body, and a faceplate extending generally radially inward from the housing;

a first elastomeric lip extending generally between the first flange and the faceplate and including a base and a tip, wherein the tip is oriented generally radially inward;

a second elastomeric lip extending generally between the second flange and the first flange and including a base and a tip, wherein the tip is oriented generally radially outward; and

a third elastomeric lip including a base secured to the first flange and a tip displaceable against the housing, wherein the tip is oriented both generally radially and axially outward.

25. The seal of claim 24, wherein the tip of the first elastomeric lip has a generally acute point.

26. The seal of claim 25, wherein the first elastomeric lip has an acute undercut angle.

27. The seal of claim 24, wherein the base of the first elastomeric lip is secured to the first flange, the tip of the first elastomeric lip is displaceable against faceplate, and the tip of the first elastomeric lip is oriented both generally axially outward and radially inward.

28. The seal of claim 24, wherein the first elastomeric lip is configured and oriented to guide inward traveling debris from the tip of the first elastomeric lip towards the base of the first elastomeric lip.

29. The seal of claim 24, wherein the base of the second elastomeric lip is secured to the housing, the tip of the second elastomeric lip is displaceable against the sleeve, and the tip of the second elastomeric lip is oriented both generally axially and radially outward.

30. The seal of claim 29, wherein the base of the second elastomeric lip is secured to the second flange.

31. The seal of claim 29, wherein the tip of the second elastomeric lip is displaceable against the first flange.

32. The seal of claim 24, wherein the tip of the third elastomeric lip is displaceable against the case body.

33. The seal of claim 24, wherein the tip of the third elastomeric lip is displaceable against a part of the housing that is generally parallel to the longitudinal axis of the shaft.

34. The seal of claim 24, wherein the faceplate comprises a parallel faceplate portion that is generally parallel to the longitudinal axis of the shaft, and a front cover portion that extends generally radially inward from the parallel faceplate portion.

35. The seal of claim 34, wherein the faceplate further comprises a second portion that extends generally radially inward from the parallel faceplate portion.

36. The seal of claim 24, further comprising a fourth elastomeric lip including a base secured to the housing and a tip displaceable against the sleeve.

37. The seal of claim 36, wherein the base of the fourth elastomeric lip is secured to the second flange.

38. The seal of claim 36, wherein the tip of the fourth elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the longitudinal axis of the shaft.

39. The seal of claim 36, wherein the tip of the fourth elastomeric lip is oriented generally axially outward.

40. The seal of claim 36, wherein the tip of the fourth elastomeric lip is oriented generally axially inward.

41. The seal of claim 36, further comprising a fifth elastomeric lip including a base secured to the housing and a tip displaceable against the sleeve.

42. The seal of claim 41, wherein the base of the fifth elastomeric lip is secured to the second flange.

43. The seal of claim 41, wherein the tip of the fifth elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the longitudinal axis of the shaft.

44. The seal of claim 41, wherein the tip of the fifth elastomeric lip is oriented generally axially outward.

45. The seal of claim 41, wherein the tip of the fifth elastomeric lip is oriented generally axially inward.

46. The seal of claim 41, further comprising a sixth elastomeric lip including a base secured to the housing and a tip displaceable against the sleeve.

47. The seal of claim 46, wherein the base of the sixth elastomeric lip is secured to the second flange.

48. The seal of claim 46, wherein the tip of the sixth elastomeric lip is displaceable against a part of the sleeve that is generally parallel to the longitudinal axis of the shaft.

49. The seal of claim 46, wherein the tip of the sixth elastomeric lip is oriented generally axially inward.

50. The seal of claim 46, further comprising a garter spring associated with the sixth elastomeric lip.

51. The seal of claim 24, further comprising a fourth elastomeric lip including a base secured to the faceplate and a tip oriented generally radially inward.

52. A seal for sealing a shaft, the seal comprising
a sleeve constructed to be disposed generally coaxially around the shaft;
a first flange extending radially outward from said sleeve;

a first elastomeric lip connected to and extending generally radially outward from said first flange, and a second elastomeric lip connected to said first flange and extending axially outward from said first flange and radially inward toward the shaft;

an outer housing constructed to generally surround said sleeve, first flange, first elastomeric lip and second elastomeric lip and having a first elastomeric lip contacting surface and a second elastomeric lip contacting surface;

a second flange operably coupled to said outer housing extending radially inward toward said sleeve; and

a third elastomeric lip connected to said second flange and biased against said sleeve.

53. The seal of claim 52, further comprising a fourth elastomeric lip connected to said second flange and extending generally radially inward toward said sleeve.

54. The seal of claim 52, further comprising a fourth elastomeric lip connected to said second flange and extending generally radially outward toward said first flange.

55. The seal of claim 52, wherein the outer housing comprises an outer casing including at least a portion that is generally parallel to said sleeve and an outer plate including at least a portion that is generally perpendicular to said outer casing and said sleeve.

56. The seal of claim 55, wherein said second elastomeric lip contacts said outer plate.

57. The seal of claim 56, further comprising a fourth elastomeric lip connected to and extending radially inward from said outer plate.

58. The seal of claim 56, wherein said second elastomeric lip has an angular cross section.

59. The seal of claim 56, wherein said outer casing is made of metal and has a least two separate metal sections connected to each other whereby a substantial portion of each of the two metal sections are in a side-by-side relationship.

60. The seal of claim 56, wherein said outer plate includes a second portion that extends next to and contacts said outer casing whereby a portion of each are parallel to each other.

61. The seal of claim 60, wherein said outer casing is radially inside said second portion of said outer plate.

62. The seal of claim 60, wherein the outer casing is radially outside said second portion of said outer plate.

63. A seal for sealing a shaft, the seal comprising
a sleeve constructed to be disposed generally coaxially around the shaft;
an outer casing spaced apart from and surrounding said sleeve;

a first and second outer casing flanges; said first and second outer casing flanges operably coupled to and having a portion generally perpendicular to said outer casing;

a first and second elastomeric sealing lip coupled to said first casing flange and contacting said sleeve;

a sleeve flange extending radially outward from said sleeve;

a third elastomeric lip connected to and extending generally radially outward from said sleeve flange, and a fourth elastomeric lip connected to said sleeve flange and extending axially outward from said sleeve flange and radially inward toward the shaft and contacts said second casing flange.

64. The seal of claim 63, wherein said second outer casing flange has a second portion that is generally parallel to said sleeve and outer casing and is in contact with the outer casing.

65. The seal of claim 64, wherein the second portion of the second outer casing flange is radially outside the outer casing.

66. The seal of claim 64, wherein the second portion of the second outer casing flange is radially inside the outer casing.